TRANSACTIONS

OF THE

American Society of Civil Engineers.

INDEX.

VOLUME XXVIII.

JANUARY TO JUNE, 1893.

NOTE.—In this Index, Subjects and Writers are given Alphabetically. Titles of Papers are enclosed by quotation marks when indexed alone or under the Author's name. When indexed under the name of a person discussing the paper, the titles are not so enclosed. Titles of papers are entered with reference to the subject and also under the first significant word.

INDEX.

VOLUME XXVIII.

JANUARY TO JUNE, 1893.

"ADDRESS AT THE ANNUAL CONVENTION," at Chicago, August 4th, 1893. Wm. Metcalf, 391.

ALLEN, T. A. Rail Sections, 441.

ANDERSON, LATHAM. Road Construction, 91.

ASPHALTUM.
Effect of temperature on— S. Whinery, 135.
For Reservoir Linings. Paper No. 566, xxvii, 629.
Discussion: R. C. Gemmell, 130; C. B. Brush, 134; S. Whinery, 135; J. F. Flagg, 138; W. B. Parsons, 139; R. L. Harris, 139; F. Crowell, 139; M. Fargusson, 140; F. Collingwood, 142; J. F. O'Rourke, 142; E. P. North, 143.

AQUEDUCTS.
Croton— James Duane, 26.

AUGST, K. Rail Sections, 434.

AYCRIGG, WM. A. Combination Bridges, 44.

BABB, CYRUS C. "Rainfall and Flow of Streams," 323.

BACOT, W. S. Road Construction, 116.

BECKER, M. J. Rail Sections, 432.

BISSELL, H. Rail Sections, 434.

BLACK, WM. M. Jetty Harbors of the Pacific Coast, 386.

BLASTING.
Rock—under Water. S. Whinery, 146; A. McC. Parker, 147; E. P. North, 148.

BOGART, JOHN.
Rainfall and River Flow, 339.
River Improvement, 448.
Tuberculation in Water Pipes, 259.

BONTECOU, D. "Notes on Cost of Operating Cable Railways," 250, 461.

BORINGS.
Brooklyn Bridge Foundations. F. Collingwood, 17.
"In Broadway, New York." William Barclay Parsons, 13.
Discussion: R. L. Harris, 15; J. Foster Flagg, 16; C. B. Brush, 16; F. Collingwood, 17; C. W. Hunt, 17; W. B. Parsons, 17.

BOUSCAREN, G. "Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge," 47, 369.

BRACKETT, Dexter. Tuberculation in Water Pipes, 268.

BRADLEY, C. W. Railway Signaling, 290.

BRENDLINGER, P. F. Cable Railways, 456.

BRIDGES.
Allegheny Suspension— F. Collingwood, 359.
Borings for Foundation of Brooklyn— F. Collingwood, 17.
Combination— Mendes Cohen, 43; Wm. A. Aycrigg, 44.
First Bollman— Mendes Cohen, 44.
"Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge." G. Bouscaren, 47.
Tensile Strength of Cable of Covington and Cincinnati Suspension Bridge. G. Bouscaren, 49.

BRINCKERHOFF, H. W. Tuberculation in Water Pipes, 261.

BROUGHTON, U. H. "Shone Hydro-Pneumatic System of Sewerage," 58, 64, 66, 69, 73.

BROWN, George M. Rail Sections, 440.

BROWN, William H. Rail Sections, 444.

BRYANT, B. H. Rail Sections, 436.

BRUSH, Charles B.
Asphaltum for Reservoir Linings, 134.
Borings in Broadway, New York, 16.
River Improvement, 445.
Tuberculation in Water Pipes, 257.

BUCHHOLZ, C. W. Rail Sections, 434.

BUCK, L. L. Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 360.

BURWELL, Blair, Jr. Rail Sections, 440.

CAIN, William. The Transition Curve, 205.

CABLES.
Allegheny Suspension Bridge— F. Collingwood, 359, 363.
Bending of Pins in Anchor Bars. L. L. Buck, 361.
Niagara Suspension Bridge— L. L. Buck, 360.
Removal of Iron Rust. F. Collingwood, 368.
Slipping of Clamps on Wire Ropes. F. Collingwood, 364.

CABLE RAILWAYS.
Cost of Operating— D. Bontecou, 250.

CABLE-WAY.
Cost of Handling Ore by— S. Miller, 144.
Used in Construction of Sodom Dam, W. McCulloh, 192, 198.

CALLANAN, P. Road Construction, 106.

CARR, ALBERT. Tuberculation in Water Pipes, 261.

CARTWRIGHT, ROBERT. "Construction of the Power-House of the Rochester Power Company, Adjacent to Genesee Falls, Rochester, N. Y.," 19.

CEMENT.
American Natural—Tests of. W. McCulloh, 190, 197.
Portland—Tests of. W. McCulloh, 190, 197.
Preservative Quality for Iron. G. Bouscaren, 48.
Protection against Bilge Water. H. S. Haines, 366.
Protection against Oxidation. T. Cooper, 369.
Strength of American and Portland— T. C. Clarke, 349.

CHEEVER, A. S. Rail Sections, 442.

CHURCHILL, CHARLES S. Rail Sections, 433.

CLARKE, T. C.
Cable Railways, 459.
Construction of a Water-Tight Masonry Dam, 349.
The Old-Time Water Wheels of America, 247.

COHEN, MENDES. Combination Bridges, 43.

COLLINGWOOD, F.
Asphaltum for Reservoir Linings, 142.
Borings in Broadway, N. Y., 17.
Detroit Union Depot Viaduct, 315.
Old-Time Water Wheels of America, 245.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 358.
Tuberculation in Water Pipes, 265.

COLUMNS.
Plaster of Paris for Leveling up Under— J. W. Schaub, 315.

COMBINATION BRIDGES.
See *Bridges.*

COMMITTEES—REPORT OF.
Standard Rail Sections, 425.

"CONSTRUCTION OF THE POWER-HOUSE of the Rochester Power Company, Adjacent to Genesee Falls, Rochester, N. Y." Robert Cartwright, 19.

"CONSTRUCTION OF A WATER-TIGHT MASONRY DAM." Walter McCulloh, 185.
Discussion: D. FitzGerald, 348; T. C. Clarke, 349; S. B. Russell, 350; E. S. Gould, 350; W. McCulloh, 351.

COOPER, SAMUEL L. Road Construction, 112.

COOPER, THEODORE. Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 368.

CRAIGHILL, WILLIAM P. River Improvement, 449.

CROES, J. J. R.
River Improvement, 446.
Shone Hydro-Pneumatic System of Sewerage, 59.

CROWELL, FOSTER.
Asphaltum for Reservoir Linings, 139.
Railway Signaling, 276.
Road Construction, 89.
Shone Hydro-Pneumatic System of Sewerage, 58.

CURRENTS.
On Pacific Coast. T. W. Symons, 156.

CURVES.
Transition— Conway R. Howard, 32; Arthur N. Talbot, 35; Wm. Cain, 205.

DAM.
Sodom— W. McCulloh, 186; D. FitzGerald, 348; T. C. Clarke, 349; S. B. Russell, 350; E. S. Gould, 350.
Wing Dams, James River, Va. H. D. Whitcomb, 216, 220.

DE COURCY, B. W. Jetty Harbors on the Pacific Coast, 376.

"DETROIT UNION DEPOT VIADUCT," J. W. Schaub, 309.
Discussion, F. Collingwood, 315; C. Macdonald, 315; W. G. Triest, 316; C. E. Moore, 317; J. W. Schaub, 321.

DIKES.
Pile— A. J. Frith, 383.

DODGE, J. T.
Cable Railways, 458.
Old-Time Water Wheels of America, 247.

DORSEY, E. B. Rainfall and River Flow, 339.

DOWNE, GEORGE. "Street Motors on the Government Tramways at Sidney, N. S. W.," 150.

DREDGING.
In James River. H. D. Whitcomb, 228.
Regulation sometimes cheaper than— H. D. Whitcomb, 453.
Permanency of Result of— W. R. Hutton, 446; J. J. R. Croes, 447; C. B. Brush, 447; W. P. Craighill, 451.

Rock— E. B. Gosling, 445; W. R. Hutton, 446; H. D. Whitcomb, 452.

DUANE, JAMES. "The Effect of Tuberculation on the Delivery of a 48-in. Water Main," 26, 274.

DUN, JAMES. Rail Sections, 436.

DUNHAM, H. F. Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 367.

DYNAMITE.
Unfreezable— E. E. R. Tratman, 149.

"EFFECT OF TUBERCULATION on the Delivery of a 48-in. Water Main." James Duane, 26.
Discussion: C. B. Brush, 257; J. Bogart, 259; W. B. Parsons, 260; H. W. Brinckerhoff, 261; A. Carr, 261; W. Metcalf, 261; W. R. Hutton, 263; L. L. Tribus, 264; F. Collingwood, 265; D. FitzGerald, 266; C. C. Hopkins, 266; M. Merriman, 267; D. Bracket, 268; J. C. Trautwine, Jr., 271; C. W. Sherman, 273; J. Duane, 274; D. M. Greene, 352.

ELECTRIC ROCK BLASTING.
Discussion: Spencer Miller, 144; S. Whinery, 145; James Owen, 147; G. R. Hardy, 147; A. McC. Parker, 147; E. P. North, 148; E. E. R. Tratman, 149.

ELEVATED RAILROADS.
Berliner Stadtbahn. W. G. Triest, 316.

EROSION OF RIVER BANKS.
Annual rate of— J. A. Ockerson, 403.
Cultivation does not affect— J. A. Ockerson, 406.
"Of River Banks of the Mississippi and Missouri Rivers." J. A. Ockerson, 396.
Relation between caving and— J. A. Ockerson, 404.
Tables of— J. A. Ockerson, 409.

FARGUSSON, M. Asphaltum for Reservoir Linings, 140.

FITZGERALD, D.
Construction of a Water-Tight Masonry Dam, 348.
Tuberculation in Water Pipes, 266.

FLAGG, J. FOSTER.
Asphaltum for Reservoir Linings, 138.
Borings in Broadway, N. Y., 16.
Shone Hydro-Pneumatic System of Sewerage, 59.

"FLOOD WAVES IN SEWERS and their Automatic Measurement." Alva J. Grover, 2.
Discussion: Clemens Herschel, 10; A. J. Grover, 10, 204; A. N. Talbot, 199.

FORD, P. D. Rail Sections, 435.

FORMULAS.
For Flow of Water in Sewers. A. N. Talbot, 200.
For Displacement of Viaducts by Wind. J. W. Schaub, 318; R. Moore, 318.

FRITH, A. J.
Jetty Harbors of the Pacific Coast, 382.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 364.

FRIZELL, J. P. "The Old-Time Water Wheels of America," 237, 245.

FTELEY, A.
Rainfall and River Flow, 338.
Shone Hydro-Pneumatic System of Sewerage, 63.

GAUGE.
For Measurement of Flood Waves in Sewers. A. J. Grover, 3.
Rain— A. J. Grover, 2.

GEMMELL, R. C. Asphaltum for Reservoir Linings, 130.

GENESEE RIVER. Water-Power at Rochester. R. Cartwright, 19.

GOSLING, E. B.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 368.
River Improvement, 445.

GOULD, E. S. Construction of a Water-Tight Masonry Dam, 350.

GRANT, T. H. Railway Signaling, 285.

GRANT, Wm. H. Road Construction, 85.

GREENE, D. M. Tuberculation in a 48-in. Water-Main, 357.

GROVER, Alva J. "Flood Waves in Sewers and their Automatic Measurement," 2, 204.

HAINES, H. S.
Railway Signaling, 280.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 366.

HALL, James. Road Construction, 122.

HANDY, E. A. Rail Sections, 443.

HANNAFORD, E. P. Rail Sections, 436.

HARBORS.
Columbia River, Oregon. T. W. Symons, 167.
Coos Bay. T. W. Symons, 159.
Galveston, Texas. D. S. Stanley, 380.

Port Orford, Oregon. T. W. Symons, 159.
San Pedro, Cal. T. W. Symons, 159.
Wilmington, Cal. T. W. Symons, 170.
Yaquina Bay, Oregon. T. W. Symons, 160.

HARDY, GEORGE R.
Electric Rock Blasting, 147.
Railway Signaling, 287.

HARRIS, R. L.
Asphaltum for Reservoir Linings, 139.
Borings in Broadway, New York, 15.

HAWKS, J. D. Rail Sections, 434.

HERING, RUDOLPH. Shone Hydro-Pneumatic System of Sewerage, 70.

HERSCHEL, CLEMENS.
Flood Waves in Sewers, 10.
Rainfall and River Flow, 342.

HOPKINS, C. C. Tuberculation in Water Pipes, 265.

HOWARD, CONWAY B. The Transition Curve, 32.

HOWE, E. W. Road Construction, 82.

HOYT, S. T., JR. Rail Sections, 439.

HOYT, WM. E. Rail Sections, 439.

HUNT, CHARLES WARREN. Borings in Broadway, New York, 17.

HUTTON, W. R.
Rainfall and River Flow, 338.
River Improvement, 446.
Tuberculation in Water Pipes, 263.

"IMPROVEMENT OF JAMES RIVER, VA." H. D. Whitcomb, 209.
Discussion: C. B. Brush, 445; E. B. Gosling, 445; W. R. Hutton, 446; J. J. R. Croes, 446; J. Bogart, 448; F. S. Washburn, 448; W. P. Craighill, 449; H. D. Whitcomb, 452.

IRRIGATION.
Water Wheels used in— A. McC. Parker, 249.

JETTIES.
Columbia River, Oregon. T. W. Symons, 167, 178.
Coos Bay, Oregon. T. W. Symons, 175.
Coquille River, Oregon. T. W. Symons, 175.
Cost of—at Columbia River. G. Y. Wisner, 373.
Cost of—at Yaquina Bay. G. Y. Wisner, 373.
Galveston Harbor. D. S. Stanley, 380.
Height of— T. W. Symons, 176; W. A. Jones, 379.
Humboldt Bay, Cal. T. W. Symons, 174, 181.
"Jetty Harbors on the Pacific Coast." T. W. Symons, 155.

Discussion: G. Y. Wisner, 372; G. H. Mendell, 374; B. W. DeCourcy, 376; W. A. Jones, 377; D. S. Stanley, 380; C. Macdonald, 381; A. J. Frith, 382; T. W. Symons, 383; W. M. Black, 386.
Mattress Car used in Construction of— T. W. Symons, 163.
Mattress Foundations for— W. M. Black, 387.
Mattresses at Galveston destroyed by Teredo. D. S. Stanley, 380.
Relative Value of High and Low— W. M. Black, 388.
Siuslaw River, Oregon. T. W. Symons, 176.
Wilmington Harbor, California. T. W. Symons, 170, 181.
Yaquina Bay, Oregon. T. W. Symons, 160, 179.

JOHNSON, HENRY. Railway Signaling, 295.

JONES, WILLIAM A. Jetty Harbors of the Pacific Coast, 377.

KATTÉ, WALTER. Rail Sections, 437.

KENDRICK, J. W. Rail Sections, 428.

KIMBALL, A. Rail Sections, 435.

LE VALLE, M. Old-Time Water Wheels of America, 249.

LIMESTONE.
Analysis of— E. P. North, 127.

McCULLOH, WALTER. "The Construction of a Water-Tight Masonry Dam," 185, 351.

McHENRY, E. H. Rail Sections, 428.

McCREARY, R. D. Rail Sections, 442.

MACDONALD, CHARLES.
Detroit Union Depot Viaduct, 315.
Jetty Harbors of the Pacific Coast, 381.
Rainfall and River Flow, 337.

MARSHALL, H. M. Rainfall and River Flow, 340.

MASONRY.
Laying of—in Freezing Weather. W. McCulloh, 197.

MENDELL, G. H. Jetty Harbors of the Pacific Coast, 374.

MERRIMAN, M. Tuberculation in Water Pipes, 267.

METCALF, WILLIAM.
Address at the Annual Convention, August 4th, 1893, 391.
Tuberculation in Water Pipes, 261.

MILLER, SPENCER. Electric Rock Blasting, 144.

MILLS, A. L. Rail Sections, 442.

MISSISSIPPI RIVER.
Cut-Offs. J. A. Ockerson, 400.
Erosion—Annual Rate of. J. A. Ockerson, 403.
Erosion of Banks of— J. A. Ockerson, 401.
Erosion Tables of— J. A. Ockerson, 409.

Lateral Movement of— J. A. Ockerson, 398.
Maps of—1768 and 1893. J. A. Ockerson, 398.

MONTFORT, R. Rail Sections, 438.

MOORE, C. E. Detroit Union Depot Viaduct, 317.

MORISON, GEORGE S. Minority Report on Standard Rail Sections, 429.

MOTORS, STEAM.
Cost of Working—in Sydney, N. S. W. G. Downe, 151.

NEWELL, F. H. Rainfall and River Flow, 344.

NICHOLS, O. F.
Cable Railways, 457.
Railway Signaling, 278.

NORTH, EDWARD P.
Asphaltum for Reservoir Linings, 143.
Electric Rock Blasting, 148.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 368.
Road Construction, 124.

"NOTES ON COST OF OPERATING CABLE RAILWAYS." D. Bontecou, 250.
Discussion: P. F. Brendlinger, 456; O. F. Nichols, 457; J. T. Dodge, 458; T. C. Clarke, 458; E. E. R. Tratman, 459; D. Bontecou, 461.

OASTLER, W. C. Road Construction, 94.

OCKERSON, J. A. "Erosion of River Banks of the Mississippi and Missouri Rivers," 396.

O'DONNELL, JOHN P. Railway Signaling, 276.

"OLD-TIME WATER WHEELS OF AMERICA." Joseph P. Frizell, 237.
Discussion: F. Collingwood, 245; T. C. Clarke, 247; J. T. Dodge, 247; M. LeValle, 249; A. McC. Parker, 249; L. L. Tribus, 249; J. P. Frizell, 245, 246.

O'ROURKE, J. F.
Asphaltum for Reservoir Linings, 142.
Road Construction, 120.

OWEN, JAMES.
Electric Rock Blasting, 147.
Road Construction, 127.

PACIFIC COAST.
Drift Timber on— T. W. Symons, 159.
Profile of Ocean Slopes on— T. W. Symons, 156.
Sand Movement on— T. W. Symons, 158.

PARKER, A. McC.
Electric Rock Blasting, 147.
Old-Time Water Wheels of America, 249.

PARSONS, Wm. Barclay.
Asphaltum for Reservoir Linings, 139.
"Borings in Broadway, New York," 13, 16.
Shone-Hydro Pneumatic System of Sewerage, 63.
Tuberculation in Water Pipes, 260.

PERRY, T. H. Rail Sections, 443.

PIPES.
Coefficient for Tuberculated— M. Merriman, 267.
Leakage from Water— C. B. Brush, 258; H. W. Brinckerhoff, 261; James Duane, 274.
Rustless—Duration of. L. L. Tribus, 264; H. W. Brinckerhoff, 264.
Tuberculation in Water— James Duane, 261, 274.

PRINCE, Edward. Road Construction, 76.

PROUT, H. G. Railway Signaling, 277.

PUMPS.
Sewage—Efficiency of. F. P. Stearns, 68; U. H. Broughton, 75.

QUARRYING.
Cost of— S. Whinery, 145.
Fuses, Leading Wires. S. Whinery, 145, 146.

RAILROADS, ELEVATED.
Berliner Stadtbahn. W. G. Triest, 316.

RAILROADS, TRACK.
Rails. Final Report of Committee on Standard Rail Sections, 425.

RAILWAY SIGNALING.
Paper No. 560 (xxvii, 515).
Discussion: F. Crowell, 276; H. G. Prout, 277; O. F. Nichols, 278; H. S. Haines, 280; T. H. Grant, 285; Theodore Voorhees, 284; G. R. Hardy, 287; C. W. Bradley, 290; E. E. R. Tratman, 291; H. Johnson, 295; J. P. O'Donnell, 276.

RAILWAYS.
Cost of Operating Cable— D. Bontecou, 250.

RAINFALL.
And Flow in Croton River. W. E. Worthen, 346.
Comparison between—and River Flow. Clemens Herschel, 343.
"Rainfall and River Flow." Cyrus C. Babb, 323.
Discussion: C. Macdonald, 337; W. R. Hutton, 338; A. Fteley, 338; E. B. Dorsey, 339; W. E. Worthen, 339; J. Bogart, 339; H. M. Marshall, 340; C. Herschel, 342; F. H. Newell, 344.

Difference of Flow from Contiguous Areas. A. Fteley, 338.
Gauging of— A. J. Grover, 6.
Intensity of—in short and long continued rains. A. N. Talbot, 200.
Maximum discharge not at highest gauge reading. H. M. Marshall, 340.
Reservoirs for regulating flow of— C. Macdonald, 338.
River flow not directly obtainable from— Clemens Herschel, 342.

REPORT (Final) of the Committee on Standard Rail Sections, 425.

RESERVOIRS.
Asphaltum Lining for— See *Asphaltum.*
Sodom and Bog Brook— W. McCulloh, 186.

"RESTORATION OF THE CABLE ENDS of the Covington and Cincinnati Suspension Bridge." G. Bouscaren, 47.
Discussion: F. Collingwood, 358; L. L. Buck, 360; H. B. Seaman, 363; John Thomson, 363; A. J. Frith, 364; S. Whinery, 365; H. S. Haines, 366; H. F. Dunham, 367; E. B. Gosling, 368; E. P. North, 368; T. Cooper, 368; G. Bouscaren, 369.

RIVERS.
Connecticut—Flow of. C. C. Babb, 325.
Croton—Flow of. C. C. Babb, 329.
Genesee—Water-Power of. R. Cartwright, 19.
James, Va.—Improvement of. H. D. Whitcomb, 209.
Contraction works for— W. P. Craighill, 450.
Gauging of— H. D. Whitcomb, 211.
Mississippi. See *Mississippi River.*
Monthly percentage of discharge of— C. C. Babb, 335.
Neshaminy—Flow of. C. C. Babb, 329.
Potomac—Flow of. C. C. Babb, 330.
Savannah—Flow of. C. C. Babb, 330.
Sudbury—Flow of. C. C. Babb, 328.
Surface slope of—in freshets. H. D. Whitcomb, 230.

ROAD CONSTRUCTION.
Paper No. 565 (xxvii, 603).
Discussion: E. Prince, 76; E. W. Howe, 82; W. H. Grant, 85; F. Crowell, 89; L. Anderson, 91; W. C. Oastler, 94; P. Callanan, 106; S. L. Cooper, 112; E. E. R. Tratman, 113; H. M. Wilson, 115; W. S. Bacot, 116; O. Saabye, 117; J. F. O'Rourke, 120; C. Tomkins, 121; J. Hall, 122; E. P. North, 124; J. Owen, 127.

ROADS.
Broad Tires. E. Prince, 78; E. P. North, 125; O. Saabye, 119.
In Central Park, N. Y. W. H. Grant, 85; E. P. North, 124.
In Denmark. O. Saabye, 118.
In Fairmount Park, Phila. F. Crowell, 90.

In India. H. M. Wilson, 115.
Material for— 101, 102; P. Callanan, 106; E. Mitchell, 111; E. E. R. Tratman, 113; W. S. Bacot, 116; J. Hall, 123.
Patching of— E. W. Howe, 82.
Repairing— E. Mitchell, 111; J. Owen, 129.
Steam Rolling vs. Horse Rolling. E. Prince, 76; E. W. Howe, 84, 98, 100, 105; P. Callanan, 108; W. S. Bacot, 116; O. Saabye, 118–120; E. P. North, 124.
Telford and Macadam—compared. W. S. Bacot, 117.
Use of Road Scrapers. E. P. North, 125.
Water used in rolling. W. S. Bacot, 116.

ROCHESTER POWER COMPANY—Plant of. R. Cartwright, 20.

RODD, Thos. Rail Sections, 431.

ROPE TRANSMISSION—Speed of. R. Cartwright, 23.

RUSSELL, S. B. Construction of a Water-Tight Masonry Dam, 350.

RUSSELL, W. H. Rail Sections, 439.

SAABYE, Oscar. Road Construction, 117.

SAUNDERS, William L. Shone Hydro-Pneumatic System of Sewerage, 59.

SCHAUB, J. W. "The Detroit Union Depot Viaduct," 309, 321.

SEAMAN, H. B. Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 363.

SEWAGE AND SEWERAGE.
"Flood Waves in Sewers." A. J. Grover, 1.
Formulas for Flow of Water in Sewers. A. N. Talbot, 200.
Gauge for Sewers. A. J. Grover, 3.
Shone Hydro-Pneumatic System. Discussion, 57.
Storm Shield for Sewers. A. J. Grover, 5.

SHERMAN, C. W. Tuberculation in Water Pipes, 273.

SHONE EJECTORS.
Efficiency of— U. H. Broughton, 69, 75.

SHONE HYDRO-PNEUMATIC SYSTEM OF SEWERAGE.
Paper No. 568 (xxvii, 659).
Discussion: F. P. Stearns, 58, 68; F. Crowell, 58; J. J. R. Croes, 59, 61; J. F. Flagg, 59; W. L. Saunders, 59, 62; W. B. Parsons, 63; A. Fteley, 63; F. W. Skinner, 67; R. Hering, 70; U. H. Broughton, 58, 64, 66, 69, 73.

SIGNALING. See *Railway Signaling.*

SKINNER, F. W. Shone Hydro-Pneumatic System of Sewerage, 67.

STANLEY, D. S. Jetty Harbors of the Pacific Coast, 380.

STEAM MOTORS.
Cost of Working—Sydney, N. S. W. G. Downe, 151.
STEARNS, F. P. Shone Hydro-Pneumatic System of Sewerage, 57.
"STREET MOTORS on the Government Tramways at Sydney, N. S. W." George Downe, 150.
SYMONS, THOMAS W. "Jetty Harbors of the Pacific Coast," 155, 383.
TALBOT, ARTHUR N.
Flood Waves in Sewers, 199.
The Transition Curve, 32.
THOMSON, JOHN. Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 363.
TIDES.
On Pacific Coast. T. W. Symons, 160.
On Oregon Coast. G. H. Mendell, 376.
Range of—in James River, Va. H. D. Whitcomb, 212.
TOMKINS, CALVIN. Road Construction, 121.
TRANSITION CURVE.
Papers No. 528 (xxvi, 473) and 536 (xxvii, 18).
Discussion: Conway R. Howard, 32; A. N. Talbot, 32; W. Cain, 205.
TRATMAN, E. E. R.
Cable Railways, 460.
Electric Rock Blasting, 149.
Railway Signaling, 291.
Road Construction, 113.
TRAUTWINE, JOHN C., JR. Tuberculation in Water Pipes, 271.
TRIBUS, L. L.
Old-Time Water Wheels of America, 249.
Tuberculation in Water Pipes, 264.
TRIEST, W. G. Detroit Union Depot Viaduct, 316.
TUBERCULATION.
"In Water Pipes." James Duane, 26.
Cause of—in Water Pipes. C. B. Brush, 261; W. R. Hutton, 263; L. L. Tribus, 264; D. FitzGerald, 266; D. Bracket, 268.
Loss of head from— W. B. Parsons, 261; C. W. Sherman, 273.
VAUGHN, G. W. Rail Sections, 441.
VIADUCTS.
Detroit Union Depot— J. W. Schaub, 309.
Effects of friction longitudinally on— C. E. Moore, 319.
Formula for displacement of—by wind. J. W. Schaub, 318; R. Moore, 318.
VOORHEES, THEODORE. Railway Signaling, 284.
WASHBURN, F. S. River Improvement, 448.

WATER—FLOW OF.
Kutter's formula. James Duane, 275; J. C. Trautwine, Jr., 271.
WATER, FLOW OF—IN PIPES.
In Aqueduct Mains in Harlem, 30.
In Croton Aqueduct, at Sing Sing. J. Duane, 29.
In 48-in. Water Main. J. Duane, 31.
Loss of Head through Tuberculation. J. Duane, 28.
WATER-POWER.
Of Genesee River at Rochester. R. Cartwright, 79.
WATER WHEELS.
Burden—at Troy. O. F. Nichols, 248.
Cast-Iron— F. Collingwood, 245; J. P. Frizell, 245; T. C. Clarke, 247; J. T. Dodge, 247.
"Old-Time—of America." J. P. Frizell, 237.
Used in Irrigation. A. McC. Parker, 249.
Used for Power for Drills. O. F. Nichols, 248.
WEBSTER, George H. Rail Sections, 440.
WEEKS, I. S. P. Rail Sections, 432.
WHINERY, S.
Asphaltum for Reservoir Linings, 135.
Electric Rock Blasting, 145.
Restoration of the Cable Ends of the Covington and Cincinnati Suspension Bridge, 365.
WHITCOMB, H. D.
"The Improvement of James River, Va," 209.
River Improvement, 452.
WILSON, H. M. Road Construction, 115.
WIRE.
Tensile strength of— G. Bouscaren, 48.
WISNER, George Y. Jetty Harbors of the Pacific Coast, 372.
WORLD'S FAIR.
Shone Ejectors used at— R. Hering, 73.
WORTHEN, Wm. E. Rainfall and River Flow, 339.